

## PLANT ITEM MATERIAL SELECTION DATA SHEET



RLD-BRKPT-00004 (HLW)

## Wash Effluent Breakpot

- Design Temperature (°F)(max/min): 368/40
- Design Pressure (psig) (internal/external): 15/FV
- Location: incell

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on sheets 5 and 6

Cannot be maintained/replaced during 40-year design life

## Operating Modes Considered:

- Normal operation.

## Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00	X	
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 304 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: 0.04 inch (includes 0.00 inch erosion allowance)

## Process &amp; Operations Limitations:

- Develop rinsing/flushing procedure for acid and water.



EXPIRES: 12/07/05

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This bound document contains a total of 6 sheets.

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### Corrosion Considerations:

The breakpot is normally empty and at ambient temperature. Steam is used for transfer and breakpot could see steam temperatures but such conditions will be of short duration. The breakpot transfers wash effluent from various vessels during non-routine operations.

#### **a General Corrosion**

In normal operation, the vessels will contain only plant wash. It is also possible that the vessel would be flushed with process wash solvent; this solvent may be water, acid, or caustic.

The uniform corrosion rate of the 300 series stainless steels in DIW at temperatures up to about boiling are generally considered to be small, <1 mpy. The corrosion rate for the stated normal operating conditions is expected to be similar.

#### *Conclusion:*

304L or 316L is expected to be sufficiently resistant to the waste solution with a probable general corrosion rate of less than 1 mpy.

#### **b Pitting Corrosion**

Chloride is known to cause pitting of stainless steels and related alloys in acid and neutral solutions. It is thought that in alkaline solutions chlorides are less likely to promote pitting except in tight crevices such as under deposits. Koch (1995) is of the opinion that fluoride will have little effect in an alkaline media.

Normally the breakpot will be at ambient temperature, assume approximately 70 °F. At this temperature, based on the work of Zapp (2000) and others, 304L stainless steel would be acceptable in the proposed conditions.

#### *Conclusion:*

Based on the stated conditions, 304L will be acceptable.

#### **c End Grain Corrosion**

End grain corrosion only occurs in metal with exposed end grains and in hot concentrated acid conditions.

#### *Conclusion:*

Not expected in this system.

#### **d Stress Corrosion Cracking**

The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, the environment and also because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), chloride stress corrosion cracking does not usually occur below about 140°F. With the assumed operating temperature and alkaline conditions, 304L is expected to be satisfactory.

#### *Conclusion:*

At the normal operating conditions, 304L stainless is acceptable.

#### **e Crevice Corrosion**

It is assumed that no long-term adherent deposits or other crevices are present. Therefore, 304L is acceptable. In addition, see Pitting.

#### *Conclusion:*

At the normal operating conditions, 304L stainless is acceptable.

#### **f Corrosion at Welds**

Weld corrosion is not considered a problem in the proposed environment.

#### *Conclusion:*

Weld corrosion is not considered a problem for this system.

#### **g Microbiologically Induced Corrosion (MIC)**

The normal operating conditions are not conducive to microbial growth.

#### *Conclusion:*

MIC is not considered a problem.

#### **h Fatigue/Corrosion Fatigue**

Corrosion fatigue is not expected to be a problem.

#### *Conclusions*

Not expected to be a concern.

**PLANT ITEM MATERIAL SELECTION DATA SHEET****i Vapor Phase Corrosion**

Vapor phase corrosion is not expected to be a concern. Further, the presence of wash rings indicates deposits can be prevented.

*Conclusion:*

Not expected to be a concern

**j Erosion**

Velocities within the vessel are expected to be low.

*Conclusion:*

Not a concern.

**k Galling of Moving Surfaces**

Not applicable.

*Conclusion:*

Not applicable.

**l Fretting/Wear**

No contacting surfaces expected.

*Conclusion:*

Not applicable.

**m Galvanic Corrosion**

No significantly dissimilar metals are present.

*Conclusion:*

Not expected to be a concern.

**n Cavitation**

None expected.

*Conclusion:*

Not believed to be of concern.

**o Creep**

The temperatures are too low to be a concern.

*Conclusion:*

Not applicable.

**p Inadvertent Nitric Acid Addition**

Higher chloride contents and higher temperatures usually require higher alloy materials. Nitrate ions inhibit the pitting and crevice corrosion of stainless alloys. Furthermore, nitric acid passivates these alloys; therefore, lower pH values brought about by increases in the nitric acid content of process fluid will not cause higher corrosion rates for these alloys. The upset condition that was most likely to occur is lowering of the pH of the vessel content by inadvertent addition of 0.5 M nitric acid. Lowering of pH may make a chloride-containing solution more likely to cause pitting of stainless alloys. Increasing the nitric acid content of the process fluid adds more of the pitting-inhibiting nitrate ion to the process fluid. In addition, adding the nitric acid solution to the stream will dilute the chloride content of the process fluid.

*Conclusion:*

The recommended materials will be able to withstand a plausible inadvertent addition of 0.5 M nitric acid.

**PLANT ITEM MATERIAL SELECTION DATA SHEET****References:**

1. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
2. Koch, GH, 1995, *Localized Corrosion in Halides Other Than Chlorides*, MTI Pub No. 41, Materials Technology Institute of the Chemical Process Industries, Inc, St Louis, MO 63141
3. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
4. Zapp, PE, 2000, *Material Corrosion and Plate-Out Test of Types 304L and 316L Stainless Steel*, WSRC-TR-2000-00434, Savannah River Site, Aiken, SC

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**Bibliography:**

1. Carpenter Technology, 1994. *Stainless Steels*, Reading, PA
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3. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
4. Hammer, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
5. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
6. Kain, RM, 1990. *Crevice Corrosion Behavior Of Stainless Steel In Chloride And Sulfate Containing Waters*, CORROSION 90 Paper No 384. Las Vegas, NACE
7. Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
8. Szklarska-Smialowska, Z, 1986. *Pitting Corrosion*, NACE, Houston TX
9. Theus, GJ and JR Cels, 1974, *Fluoride Induced Intergranular Stress corrosion Cracking of Sensitized Stainless Steel*, Corrosion Problems in Energy Conversion and Generation.
10. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
11. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

## PLANT ITEM MATERIAL SELECTION DATA SHEET

## OPERATING CONDITIONS

## PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Plant wash and drains transfer breakpot (RLD-BRKPT-00004)Facility HLW

In Black Cell?

Yes

## OPERATING CONDITIONS

Chemicals	Unit <sup>1</sup>	Contract Maximum		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l					
Chloride	g/l					
Fluoride	g/l					
Iron	g/l					
Nitrate	g/l					
Nitrite	g/l					
Phosphate	g/l					
Sulfate	g/l					
Mercury	g/l					
Carbonate	g/l					
Undissolved solids	wt %					
Other (NaMnO <sub>4</sub> , Pb,...)	g/l					
Other	g/l					
pH	N/A					
Temperature	°F					Note 2

**List of Organic Species:**

**Notes:**

1. Concentrations less than  $1 \times 10^{-4}$  g/l do not need to be reported; list values to two significant digits max.

2. Streams entering breakpots use steam for transfer for short duration, but breakpots are normally empty.

**Assumptions**

## PLANT ITEM MATERIAL SELECTION DATA SHEET

### **5.6.2 Plant Wash and Drains Transfer Breakpot (RLD-BRKPT-00004)**

#### **Routine Operations**

Receives effluent from RLD-VSL-00008 and HCP-SUMP-00001 and transfers to PWD-VSL-00033.

#### **Non-Routine Operations that Could Affect Corrosion/Erosion**

Spill of reagent, etc. to a sump.